REMARKS

This is a full and timely response to the outstanding Office Action mailed October 31, 2005. The Examiner is thanked for the thorough examination of this application, and the indication that claims 4-18, 20-24, and 30 contain allowable subject matter. The Office Action, however, rejected the remaining claims. For at least the reasons set forth herein, Applicant respectfully and requests that the rejections be withdrawn.

The Office Action objected to claims 5, 11, and 17 due to certain informalities. Applicants have amended these claims in accordance with the suggestions made by the Examiner. Accordingly, the objections have been accommodated and should now be withdrawn.

Turning now to the substantive rejections set forth by the Office Action, Applicant appreciates that claims 11-18 are now in condition for allowance (with entry of the forgoing amendment correcting only a typographical inconsistency in independent claim 11). The Office Action, however, rejected independent claim 1, as well as independent claim 19 under 35 U.S.C. § 103(a) as allegedly unpatentable over the combination of U.S. Published Application 20040169651A1 (to Everett) in view of U.S. Patent 6,557,083 to Sperber, further in view of U.S. Patent 6,384,822 to Bilodeau. For at least the reasons set forth below, Applicants respectfully disagree and request reconsideration of these rejections.

With regard to independent claim 1, claim 1 recites:

> 1. An apparatus for use in a computer graphics system, comprising:
> ***a plurality of depth buffers for storing depth data, wherein at least one of the plurality of depth buffers is configured to provide depth data for a group of pixels, wherein at least one other of the plurality of depth buffers is configured to provide depth data for each pixel of the group;***
> ***a plurality of stencil buffers, the stencil buffers configured to store stencil shadow volume data, wherein at least one of the plurality of stencil buffers is configured to provide stencil shadow volume data for the group of pixels; wherein at least one other of the plurality of stencil buffers is***

> ***configured to store stencil shadow volume data for each pixel of the group***; and
>
> control logic for controlling the plurality of stencil buffers and the plurality of depth buffers, wherein the stencil shadow volume data is generated and stored.

(*Emphasis Added*). Applicants respectfully submit that claim 1 patently defines over the cited art, as the cited art fails to disclose at least those features emphasized above.

As emphasized above, among other features, claim 1 defines "a plurality of depth buffers for storing depth data..." Strangely, the Office Action cites Everett as the principle reference as applying to this claimed feature, and yet the Office Action admits that "Everett does not teach a plurality of depth buffers..." (Office Action, page 4, line 5). The Office Action, in this regard, alleges that Sperber "describes compressed and uncompressed depth buffers" (*citing* Column 5, lines 39-57), "wherein the uncompressed depth buffer is configured to provide depth data for each pixel of the group" (*citing* Column 10, lines 16-32). Applicants respectfully disagree. In fact, these cited portions of Sperber actually state:

> Z-compression need not apply uniformly to all data stored in z-buffer **350**. For example, a determination to write data to z-buffer **350** in compressed or uncompressed format may be made, in part, by reference to the relationship between the data block to be written and the primitive locations that map to the data block. A data block **110**(b) that represents locations within the boundaries of primitive **100** can usually be compressed. As discussed below, exceptions may arise if the z-value also includes a stencil field or if certain clipping or saturation conditions prevail. A data block **110**(a) to which locations straddling a primitive boundary are mapped, is usually not compressed. Where compression is implemented through a surface function (Eq. 1), the z-values for locations on different sides of the primitive's boundaries may be governed by different surface functions. This z-compression scheme can generate erroneous results if a location outside the primitive is compressed using a surface equation that is only suitable for locations within the primitive.
>
> ...
>
> Figs 8A and 8B are block diagrams representing uncompressed formats **810** and **850** for 16-bit and 32-bit z-data, respectively, when it is stored as spans. For 16-bit format **810**, each row corresponds to one quad word (QW) of data (4 x

> 16 bits), and for 32-bit format **850**, each row corresponds to double quad word (DQW) of data (4 x 32 bits). The z-values of the 16 pixels in the span are labeled $Z_{0,0} - Z_{3,3}$. For one embodiment of 32-bit format **350**, each 32-bit value may include a 24-bit z-value and an 8-bit stencil value. Stencil values are used to indicate a portion of the screen for which drawing updates are not necessary. For example, a pixel that is obscured by a window border may include a stencil value that is to be written instead of the pixel value. For one embodiment of the invention, a span whose pixels are associated with different stencil values may not be compressed.

As can be readily verified from even a cursory reading of these cited portions of the Sperber patent, there is absolutely no teaching or suggestion of the claimed plurality of depth buffers, much less the claimed feature of at least one of the depth buffers being "configured to provide depth data for a group of pixels" and "at least one other of the plurality of the depth buffers configured to provide depth data for each pixel of the group." For at least this reason, the rejection is misplaced and should be withdrawn.

Further, the Office Action continued by alleging that "it would have been obvious...to modify the device of Everett to include a plurality of depth buffers, wherein at least one of the plurality of depth buffers is configured to provide depth data for each pixel of the group as suggested by Sperber ***because Sperber suggests that this increases the memory bandwidth*** (Col. 2, lines 13-32)." Applicants respectfully disagree. In fact, this cited portion of Sperber actually states:

> Significant amounts of texture, color, and z-data are transferred between memory and the graphics resources during the rendering stage. Since there are may be tens to hundreds of pixels per primitive, these data transfers can place significant burdens on the bandwidth of the memory channel. The consequent reduction in memory bandwidth can reduce the performance of the graphics system. This is particularly true if the graphic system is implemented in a computer system that employs a unified memory architecture (UMA). For UMA-based computer systems, the central processor unit(s) (CPU) and graphics engine have equal access to main memory. Memory demands by the graphics engine can reduce CPU performance. In addition, memory demands by one unit of the

> graphics engine can reduce the performance of other units. For example, any bandwidth used to transfer z-data for z-testing is unavailable to the unit that determines pixel textures, and the loss in bandwidth can reduce its performance.

There is absolutely no suggestion or even a hint of a motivation in this portion of Sperber regarding depth buffers, much less the configuration of a plurality of depth buffers such that "at least one of the plurality of depth buffers is configured to provide depth data for each pixel of the group," as specifically claimed (and as alleged by the Office Action). For at least this additional reason, the rejection of claim 1 is misplaced and should be withdrawn.

Simply stated, Applicants respectfully submit that the Office Action has taken excessive liberties with overly broad constructions of the teachings of the Everett and Sperber and combining otherwise disparate teachings of these references to form its rejection of claim 1. For at least these reasons, the rejection of claim 1 should be withdrawn.

Further still, the Office Action further admits that neither Everett nor Sperber teach the claimed feature of a plurality of stencil buffers being "configured to store stencil shadow volume data, wherein at least one of the plurality of stencil buffers is configured to provide stencil shadow volume data for the group of pixels" and "wherein at least one other of the plurality of stencil buffers is configured to store stencil shadow volume data for each pixel of the group." For these claimed features, the Office Action relies on the teachings of Bilodeau, citing column 3, lines 24-29. Applicants respectfully disagree with this application of Bilodeau. In this regard, the cited portions of Bilodeau actually state:

> According to one aspect of the present invention, an improved method for creating shadows in 3-D graphics relies solely on z-testing to set the stencil buffer bits for the shadows, regardless of whether the viewpoint is within the shadow volume.

> According to another aspect of the invention, a new z-test inverts the standard z-test so that only pixels having depth (z) values greater than the corresponding depth (z) value stored in the z-buffer pass the new z-test.

As can be readily verified from even a cursory reading of the above-quoted portions of Bilodeau, there is absolutely no teaching or suggestion of the claimed plurality of stencil buffers. Bilodeau (see column 3, line 40) does reference a single stencil buffer, but certainly provides no teaching or suggestion of the claimed plurality of stencil buffers, much less the claimed configuration of such a plurality of stencil buffers. For this additional reason, the rejection of claim 1 is misplaced and should be withdrawn.

As yet a separate and independent basis for the patenability of claim 1, Applicants respectfully submit that the Office Action has failed to cite a proper suggestion or motivation for combining Everett, Sperber, and Bilodeau. In combining Sperber with Everett, the Office Action alleged that the combination would have been obvious "because Sperber suggests that this increases the memory bandwidth." In further combining Bilodeau, the Office Action alleged that such would have been obvious "because Bilodeau suggests that only pixels having depth values greater than the corresponding depth value stored in the z-buffer pass the z-test." These alleged motivations are clearly improper in view of well-established Federal Circuit precedent.

It is well-settled law that in order to properly support an obviousness rejection under 35 U.S.C. § 103, there must have been some teaching in the prior art to suggest to one skilled in the art that the claimed invention would have been obvious. W. L. Gore & Associates, Inc. v. Garlock Thomas, Inc., 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

> "The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this [invention] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. ..." Both the suggestion and the expectation of success must be

> founded in the prior art, not in the applicant's disclosure... In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(*Emphasis added.*) In re Dow Chemical Company, 837 F.2d 469, 473 (Fed. Cir. 1988).

In this regard, Applicants notes that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also requires the prior art to suggest both the combination of elements and the structure resulting from the combination. Stiftung v. Renishaw PLC, 945 Fed.2d 1173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of any two or more prior art references, the prior art must properly suggest the desirability of combining the particular elements to derive a system and method for generating shadow effects using shadow volumes, as claimed by the Applicants.

When an obviousness determination is based on multiple prior art references, there must be a showing of some "teaching, suggestion, or reason" to combine the references. Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579, 42 USPQ2d 1378, 1383 (Fed. Cir. 1997) (also noting that the "absence of such a suggestion to combine is dispositive in an obviousness determination").

Evidence of a suggestion, teaching, or motivation to combine prior art references may flow, inter alia, from the references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. See In re Dembiczak, 175 F.3d 994, 1000, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in

whatever form, must nevertheless be "clear and particular." Dembiczak, 175 F.3d at 999, 50 USPQ2d at 1617.

If there was no motivation or suggestion to combine selective teachings from multiple prior art references, one of ordinary skill in the art would not have viewed the present invention as obvious. See In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998); Gambro Lundia AB, 110 F.3d at 1579, 42 USPQ2d at 1383 ("The absence of such a suggestion to combine is dispositive in an obviousness determination.").

Significantly, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. Winner Int'l Royalty Corp. v. Wang, No 98-1553 (Fed. Cir. January 27, 2000).

For at least the additional reason that the Office Action failed to identify proper motivations or suggestions for combining the various references to properly support the rejection of claim 1 under 35 U.S.C. § 103, and that rejection should be withdrawn.

For each of the various forgoing reasons, Applicants respectfully submit that the rejection of claim 1 is misplaced and should be withdrawn. For at least the same reasons, the rejections of dependent claims 2-3 are misplaced and should be withdrawn as well.

The Office Action also rejected independent claim 19 as allegedly obvious over the combination of Everett, Sperber, and Bilodeau. For at least the reasons that follow, Applicants respectfully disagree.

Independent claim 19 recites:

> 19. A computer graphics system comprising:
> depth data compression logic configured to generate a compressed depth data, where the compressed depth data corresponds to a group of pixels;

> ***shadow data compression logic configured to generate a compressed stencil shadow data, where the compressed stencil shadow data corresponds to the group of pixels, wherein the compressed stencil shadow data is generated utilizing a stencil shadow volume method;***
>
> ***shadow data generation logic configured to generate an uncompressed stencil shadow data, wherein the uncompressed stencil shadow data is generated utilizing the stencil shadow volume method; and***
>
> ***shadow data merging logic configured to selectively merge the compressed stencil shadow data with the uncompressed stencil shadow volume data.***

(*Emphasis Added*). Applicants respectfully submit that independent claim 19 patently defines over the cited art, as the cited art fails to disclose at least those features emphasized above.

The rejection of claim 19 relies principally upon the teachings of Sperber. The Office Action admits that Sperber does not teach the claimed "shadow data compression logic..." However, the Office Action alleges that Bilodeau describes this feature at column 1, lines 55-63 (Office Action, last line of page 6). Applicants respectfully disagree. In fact, this cited portion of Bilodeau actually describes:

> It is possible to perform simple arithmetic operations on the contents of the stencil buffer on a per-pixel basis as polygons are rendered. For example, the stencil buffer can be incremented or decremented, or the pixel can be rejected if the stencil value fails a simple comparison test. This is useful for effects that involve marking out a region of the frame buffer, and then performing rendering only on the marked (or unmarked) region. Good examples are volumetric effects like shadow volumes.

As can be readily verified from even a cursory review of this cited portion of Bilodeau, there is no teaching of the claimed feature of the "shadow data compression logic configured to generate a compressed stencil shadow data, ***where the compressed stencil shadow data corresponds to the group of pixels, wherein the compressed stencil shadow data is generated using a stencil shadow volume method.***" For at least this reason, the rejection of claim 19 is misplaced and should be withdrawn.

As a separate and independent basis for the patentability of claim 19, claim 19 defines "shadow data generation logic configured to generate an uncompressed stencil shadow data, wherein the uncompressed stencil shadow data is generated utilizing the stencil shadow volume method." The Office Action alleges that this element is taught by Sperber at column 12, lines 62-65 and in table 2 of that patent. Applicants respectfully disagree. In fact, the cited portion of Sperber actually states: "Consequently, even if the z-data of a block can be compressed, format **900** does not allow compression if the pixels have different stencil values." Significantly, however, there is no teaching in this cited portion of Sperber for the recited claimed element. Furthermore, claim 19 further defines "shadow data merging logic configured to selectively merge the compressed stencil shadow data with uncompressed stencil shadow volume data." The Office Action cites column5, lines 39-57 of Sperber as allegedly teaching this claimed feature. In fact, this cited portion of Sperber actually states:

> Z-compression need not apply uniformly to all data stored in z-buffer **350**. For example, a determination to write data to z-buffer **350** in compressed or uncompressed format may be made, in part, by reference to the relationship between the data block to be written and the primitive locations that map to the data block. A data block **110**(b) that represents locations within the boundaries of primitive **100** can usually be compressed. As discussed below, exceptions may arise if the z-value also includes a stencil field or if certain clipping or saturation conditions prevail. A data block **110**(a) to which locations straddling a primitive boundary are mapped, is usually not compressed. Where compression is implemented through a surface function (Eq. 1), the z-values for locations on different sides of the primitive's boundaries may be governed by different surface functions. This z-compression scheme can generate erroneous results if a location outside the primitive is compressed using a surface equation that is only suitable for locations within the primitive.

As can be readily verified from even a cursory review of this cited portion of Sperber, there is no mention or suggestion of the claimed "shadow data merging logic..." as defined by

the claim. For at least this reason, the rejection of claim 19 is misplaced and should be withdrawn.

As a separate and independent basis for the patentability of claim 19, Applicants respectfully submit that the Office Action has failed to cite proper motivations or suggestions for combining the select teachings of Everett, Sperber, and Bilodeau. In this regard, Applicants repeat and reallege the discussion set for above in connection with claim 1, wherein Applicants set for the relevant Federal Circuit precedent surrounding required suggestions to properly combine references under 35 U.S.C. § 103.

For at least the forgoing reasons, the rejection of claim 19 is misplaced and should be withdrawn. For at least the same reasons, claims 25-29, which depend from claim 19, should be allowed over the cited art.

CONCLUSION

In view of the foregoing, it is believed that all pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 08-2025.

Respectfully submitted,

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